cingular INTERACTIVE

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Mr. Julius Knapp
Deputy Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW, Room 7-B133
Washington, DC 20554

Re: Ultra-Wideband, FCC Rulemaking, ET Docket 98-153

Dear Mr. Knapp,

Pursuant to our recent ex parte meeting; I'd like to respond to questions posed to Cingular Wireless by Office of Engineering and Technology staff and also summarize our understanding of the current state of the Ultra-Wideband ("UWB") proceeding before the Federal Communications Commission ("FCC").

Current State of UWB Docket

All parties in this proceeding agree that UWB is a promising new radio technology; however, that is where the agreement ends. UWB proponents, as would be expected, argue that there are no interference issues or that these issues can be mitigated. Meanwhile, those who desire a more cautious approach to UWB introduction argue that the studies have shown that there will be significant interference. Cingular agrees with the latter group for the following reasons:

- The majority of studies have shown that there is a serious interference concern with UWB and that the effects of multiple UWB devices are additive.

- Neither all UWB devices nor their associated waveforms been studied. Nor has the interference been examined as it relates to a number of existing RF-based and non-RF-based systems.

- UWB devices will potentially interfere with base station and handset receivers used in cellular/PCS systems. This interference will have a negative impact on receiver performance causing cell shrinkage, coverage holes, degraded voice quality, decreased throughput of data, and increase in the number of failed call origination attempts.

Responses to OET Questions

Recently, Cingular presented to OET staff its concerns over the approval of UWB for widespread mass-market applications. During the presentation, members of the OET asked Cingular to provide more information, if possible, concerning the following issues.

1. The signal levels and interference levels in Cingular's cellular/PCS networks:

Cingular Wireless operates cellular and PCS networks based on TDMA (TIA/EIA-136) and also PCS networks based on GSM (PCS-1900). In each case, the minimum performance specifications for mobile stations (handsets) are available in the respective standards documents. According to the TDMA specification for minimum performance of mobile stations (TIA/EIA-136-270), the minimum receive sensitivity is defined as –103 dBm or –100 dBm, depending on the speed of the mobile station (8, 50, 100 km/hour) and multipath delay (10, 20, 41 μsec). In static conditions, the minimum sensitivity is defined to be –110 dBm. The specification also includes minimum requirements for carrier-to-interference ("C/I") (co-channel) ratio. For all mobile speeds (8, 50, 100 km/hour) the base C/I is defined to be 17 dB. When multipath delay is included (41 μsec), the required C/I ratios are 17 dB, 19 dB and 22 dB for mobile speeds of 8, 50, and 100 km/hour, respectively.

Measurements conducted recently in a typical urban area showed that signals were at acceptable levels at street level, as expected in a typical cellular/PCS network. However, in cases of severe blockage and/or shadowing, signal levels were seen as low as the minimum sensitivity levels given above (i.e., for mobile stations the typical figure of merit for minimum receive sensitivity is –103 dBm for TIA/EIA-136 TDMA and –102 dBm for PCS-1900 GSM). Mobile stations would experience similar signal levels when operating inside a building due to the building penetration losses. It is not uncommon for some calls, e.g., at hand-off boundaries, to be kept active (but perhaps not originated) even at signal levels below the typical minimum sensitivity given above.

As an example consider a TDMA PCS handset being used inside an office building, convention center, or other shadowed area. For a 30 KHz TDMA channel, the system noise is equal to the thermal noise floor (-129 dBm) plus the receiver noise figure (approximately 6 to 9 dB) or –123 to –120 dBm. Note that at the minimum receive sensitivity, -103 dBm, the required C/I of 17 dB is still satisfied. If a UWB device is allowed to operate at –53.2 dBm/MHz (i.e., 12 dB below the current Part 15 limit), it will raise the noise floor in the mobile receiver 1 dB at a distance of approximately 10 meters (32 feet).

Cingular Wireless also operates a nationwide two-way paging network, based on Mobitex technology, in the 900 MHz SMR bands. UWB would also have a detrimental impact on the performance of this network as shown in the following example. In a 12.5 KHz SMR channel, the system noise is equal to –125 dBm (-133 dBm thermal noise + 8 dB noise figure). If a UWB device is operated at –53.2 dBm/MHz, as above, the noise floor in the

mobile receiver will be raised by 1 dB at a distance of approximately 22 meters (72 feet). Also, note that the minimum receive sensitivity for the two-way pager devices is –113 dBm in static conditions and –101 dBm in multipath fading conditions. In typical service areas, signals are measured in the range –113 to –101 dBm.

As noted by some proponents of UWB systems, it may be possible that a significant number of UWB devices could be deployed indoors and in close proximity to one another. This is particularly troublesome for mobile cellular devices used indoors the signal from the base station to the mobile device will be attenuated by penetrating the building while the signal from an indoor UWB device will not be attenuated, thus raising the noise floor for the mobile receiver. As the number of UWB devices grows, the interference caused by the devices in close proximity to the victim receiver will be cumulative. Also, if UWB will be deployed in a manner similar to Bluetooth, it is conceivable that an individual could be wearing or carrying a UWB device as well as a cellular/PCS phone. In this case, the performance of the phone (including potential impact to E-911 location capability) should not be impacted.

2. The effects of interfering signals as compared to the effects of white noise:

While the effects of white noise on digital communications systems are well known, the effects of other types of signals are more difficult to determine. For each type of system, the receiver performance is maximized for the expected bandwidth, modulation, etc., that the system is designed to use. The effects of other interfering signals on the receiver will depend on the particular characteristics (bandwidth, modulation, etc.) of the interfering signal.

Using the specifications given above for cellular/PCS mobile station receivers, it is possible to estimate the differences between noise and co-channel interference. Assuming a 30 KHz TDMA channel, the noise in the system would be –129 dBm + 9 dB noise figure = -120 dBm. With minimum mobile station receiver sensitivities of –103, -100, and –100 dBm for vehicle speeds of 8, 50, and 100 km/hour, the required carrier-to-noise ratios are found to be 17, 20, and 20 dB, respectively. Comparing this to the required C/I ratios of 17, 19, and 22 dB, results in a difference of 1 to 2 dB for multipath environments. However, note that in static conditions the minimum sensitivity is –110 dBm and the difference in performance between noise and interference would be 7dB.

Recommendations

Cingular reiterates its recommendations on how the Commission should proceed:

- Limit UWB devices to spectrum above 6 GHz for most systems and below 1 GHz for ground penetrating radar.

- The operation of UWB devices should be licensed and subjected to a prior coordination process so that any interference issue can be examined as additional UWB systems are deployed. Conventional licensees and other users of UWB

technology need to be able to determine who is using UWB, and their location, to avoid causing interference and to be able to track any interference that occurs.

- Identify specific categories of UWB devices and establish proposed rules for licensing these categories based on individual waveforms, power levels, and deployment scenarios. These proposed rules must be sent out for public comment.

- Identify areas where further testing is needed, including the additive effect of multiple UWB devices.

If you have any questions, please call me at 202-419-3004.

Sincerely,

Jim Bugel

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